USER MANUAL

HART

IHP24-A
IHP24-AF
IHP24-B
IHP24-BF
IHP24-I

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1 General

This manual covers software version:

Software ID (HART): DHP-SW-015
Software Version: 3.04

1.1 Safety instructions

For a safe installation of a positioner, the following must be observed. The module must only be installed by qualified personnel who are familiar with the national and international laws, directives and standards that apply to this product as well as all instructions in this manual.

The information in this user manual is subject to changes without notice.

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2 Purpose

It is the purpose of this document, to list specifications, protocol commands and functions, the HART communication protocol in Val Control products.

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3 Specifications

3.1 Electrical specifications

Control loop	
Impedance	< 470 ohm @20mA and 9.4VDC
Linearity	< 0.1%
Temperature coefficient	0.025% / 1°C
HART	FSK, 1200Hz / 2200Hz 400-800mVpp
Galvanic isolated	
Transmitter loop	
Impedance	< 470 ohm @20mA and 9.4VDC
Linearity	< 0.1%
Temperature coefficient	0.015% / 1°C
Galvanic isolated	

Note: Control loop and transmitter loop equipment must be HART compatible.

3.1.1 Terminals

The chart below shows how to connect to the terminals on the positioner.

Control loop
1. Control loop (+)
2. Control loop (-)
Transmitter loop
3. Transmitter loop (+)
4. Transmitter loop (-)

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4 Menu

Node id Can be changed in the Menu at the following location.

Advanced menu	Default	Value	Reset	Description
6 HART				HART configuration
1 ID	0	0-63		Change the HART ID

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5 Device Identification

Manufacturer Name:	Val Controls	**Model Name(s):**	IHP24
Manufacture ID Code:	24622 (602E Hex)	**Device Type Code:**	57807 (E1CF Hex)
HART Protocol Revision	7.1	**Device Revision:**	3
Number of Device Variables	6		
Physical Layers Supported	FSK		
Physical Device Category	Control loop, DC-isolated Bus Device		

Default node ID: 0

6 Universal Commands

All universal commands are implemented

Command	Description
0	Read unique identifier
1	Read primary variable
2	Read loop current and percent of range
3	Read dynamic variables and loop current
6	Write polling address
7	Read loop current mode
8	Read Dynamic Variable Classification
9	Read Device Variables with Status
11	Read loop configuration
12	Read message
13	Read device variable status
14	Read unique identifier associated with tag
15	Read Primary Variable output information
16	Read final assembly number
17	Write message
18	Write TAG, descriptor, date
19	Write final assembly number
20	Read Long Tag
21	Read unique identifier associated with long tag
22	Write long tag

Val Controls Definitions:

- Universal Primary Variable : Control Signal
- Universal Secondary Variable : Transmitter Signal
- Universal Tertiary Variable: Position Signal
- Universal Quaternary Variable : Pressure Sensor

6.1 Burst Mode

The field device does not support burst mode

7 Device Specific Commands

All universal commands are implemented

Command	Description
38	Reset Configuration Counter
42	Device Reboot
48	Additional Status
59	Write Number of preambles

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8 User specific Commands

Command 128 – 247 is user specific commands.

8.1 Live Status – Identification

8.1.1 Read (139) Software Version

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
1-4	U32	Software Version Format: Decimal Example : 10203 decimal = ’1.02.03’

8.1.2 Read (140) Software Id

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-13	ASCII14	Software – ID Format: ASCII 14 Example ‘DDP-SW-004’

8.1.3 Read (141) Manufacturer ID

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-13	ASCII14	Manufacturer ID Format: ASCII 14 Default Value: ‘Val Controls ‘

8.1.4 Read (143) Type Name

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-13	ASCII	Type Name Format: ASCII 14 Default Value: 'IHP24-B'

8.1.5 Read (144) PCB Number

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	U32	PCB Number Value: 0 – 4294967295 Format: U32 MSB First

8.1.6 Read (20) Long Tag

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-31	ASCII32	Long TAG

8.1.7 Write (22) Long Tag

Request data bytes

Byte	Format	Description
0-31	ASCII32	Long TAG

Response data bytes

Byte	Format	Description
0-31	ASCII32	Long TAG

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8.2 Live Status – Error Log Functions

8.2.1 Read (130) Error Log

This command reads the entries in the error log.

Request data bytes

Byte	Format	Description
None		

Respons3 data bytes

Byte	Format	Description
0	U8	Number of errors in the error log
1-2	U16	Error 1 – Newest error Value: 0 - 65535
3-4	U16	Error 2 Value: 0 - 65535
5-6	U16	Error 3 Value: 0 - 65535
7-8	U16	Error 4 Value: 0 - 65535
9-10	U16	Error 5 Value: 0 - 65535
11-12	U16	Error 6 Value: 0 - 65535
13-14	U16	Error 7 Value: 0 - 65535
15-16	U16	Error 8 Value: 0 - 65535
17-18	U16	Error 9 Value: 0 - 65535
19-20	U16	Error 10 – Oldest error Value: 0 - 65535

This commands returns the latest 10 errors, with the last (newest) detected error as Error 1. The number of errors in the error log should be zero for system in operation. For a list of error codes please refer to the user manual

8.2.2 Write (131) Clear Error Log

This command Clear's the Error log

Request data bytes

Byte	Format	Description
0	U8	Clear Error Log Values: 0 Clears the log
None		

Response data bytes

Byte	Format	Description
0	U8	Clear Error Log

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8.3 Live Status – Live Status

8.3.1 Read (142) SP – Flow %

8.3.2 Read (142) PV – Flow %

8.3.3 Read (142) TM – Flow %

8.3.4 Read (142) SP – Travel %

8.3.5 Read (142) PV – Travel %

8.3.6 Read (142) SP – Flow mA

8.3.7 Read (142) PV – Flow mA

8.3.8 Read (142) TM – Flow mA

This command reads Val Controls specific live status

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-1	U16	SP – Set point – Flow % Value: 0 – 10000 Unit: 0.00 % – 100.00% Format: MSB First
2-3	U16	PV – Process value – Flow % Value: 0 – 10000 Unit: 0.00 % – 100.00% Format: MSB First
4-5	U16	TM – Transmitter – Flow % Value: 0 – 10000 Unit: 0.00 % – 100.00% Format: MSB First
6-7	U16	SP – Set point – Travel % Value: 0 – 10000 Unit: 0.00 % – 100.00% Format: MSB First

8-9	U16	PV – Process value – Travel % Value: 0 – 10000 Unit: 0.00 % – 100.00% Format: MSB First
10-11	U16	SP – Set point – Flow – mA Value: 0 – 2150 Unit: 0.00 mA – 21.50mA Format: MSB First
12-13	U16	PV – Process Value – Flow mA Value: 0 – 2150 Unit: 0.00 mA – 21.50mA Format: MSB First
14-15	U16	TM – Transmitter – Flow – mA Value: 0 – 2150 Unit: 0.00 mA – 21.50mA Format: MSB First

8.3.9 Read (146) Pulse Counter on DO1 – DO4

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-3	U32	CNT DO1 Value: 0 – 4294967295 Format: U32 MSB First
4-7	U32	CNT DO2 Value: 0 – 4294967295 Format: U32 MSB First
8-11	U32	CNT DO3 Value: 0 – 4294967295 Format: U32 MSB First
12-15	U32	CNT DO4 Value: 0 – 4294967295 Format: U32 MSB First

Read (145) DO1-DO6 Status

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	DO1 Status Default: 2 = Off Values: 1 = On 2 = Off
1	U8	DO2 Status Default: 2 = Off Values: 1 = On 2 = Off
2	U8	DO3 Status Default: 2 = Off Values: 1 = On 2 = Off
3	U8	DO4 Status Default: 2 = Off Values: 1 = On 2 = Off
4	U8	DO5 Status Default: 2 = Off Values: 1 = On 2 = Off
5	U8	DO6 Status Default: 2 = Off Values: 1 = On 2 = Off

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8.3.10 Read (210) Live Status – Read AI2-AI5

8.3.11 Read (210) Live Status – Read AO1 – AO2

8.3.12 Read (210) Live Status – Control Mode

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U16	Read AI2 Values: Value: 0 – 2150 Unit: 0.00 mA – 21.50mA
2	U16	Read AI3 Values: Value: 0 – 2150 Unit: 0.00 mA – 21.50mA
4	U16	Read AI4 Values: Value: 0 – 2150 Unit: 0.00 mA – 21.50mA
6	U16	Read AI5 Values: Value: 0 – 2150 Unit: 0.00 mA – 21.50mA
8	U16	Read AO1 Values: Value: 0 – 2150 Unit: 0.00 mA – 21.50mA
10	U16	Read AO2 Values: Value: 0 – 2150 Unit: 0.00 mA – 21.50mA
12	U8	Control Mode Status - Control mode (Local/Off/Remote) Values:

		0 = Not defined 1 = Remote 2 = Local 3 = Off 4 = ESD

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8.4 Live Status – Pump Control

8.4.1 Read (147) Live Status - Pump Status

8.4.2 Read (147) Live Status - Pump control Pressure Signal

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	Pump Status Value: 0 = Not defined 1 = Active (Pump output is powered)
1-2	U16	Pump Pressure Status Value: 0 – 50000 Unit: 0.00 Bar – 500.00 Bar Format: MSB first

8.4.3 Read (209) Live Status – Pump control Pressure switch state

8.4.4 Read (209) Live Status – Pump control Level signal

8.4.5 Read (209) Live Status – Pump Control Level switch state

8.4.6 Read (209) Live Status – Pump control Temperature signal

8.4.7 Read (209) Live Status – Pump Control Temperature switch state

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	Read Pump Control Pressure switch state Values: 1 = Pressure switch undefined NO 2 = Pressure switch undefined NC

		3 = Pressure switch low 4 = Pressure switch high 5 = Pressure switch between low and high 0 = Not used
1	U16	Read Pump Control Level Signal Values: 0 – 9999 Units: 0 = 9999mm
3	U8	Read Pump Control Level switch state Values: 0 = Level Switch Not Used 1 = Level Switch OK 2 = Level Switch Low
4	U16	Read Pump Control Temperature signal Values: 73 – 1123 Units 73 Kelvin to 1123 Kelvin (-200°C to 850°C)
6	U8	Read Pump Control Temperature switch state Values: 0 =Temperature Switch Not Used 1 = Temperature Switch OK 2 = Temperature Switch Low

8.5 Basic Menu Functions

8.5.1 Read (148) Deadband

8.5.2 Read (148) Select Flow Curve

8.5.3 Read (148) Valve action dir

8.5.4 Read (148) Regulator – Hold at open – Status

8.5.5 Read (148) Regulator – Hold at open – Time

8.5.6 Read (148) Regulator – Hold at close – Status

8.5.7 Read (148) Regulator – Hold at close – Time

8.5.8 Read (148) Regulator – Transmitter Action

8.5.9 Read (148) Regulator – Transmitter Fail position

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0-1	U16	Deadband Default: 100 = 1.0% Range: 10 – 1000 Units: 0.1% - 10%
2	U8	Flowcurve Default: 1 = Linear Values: 1 = Linear 2 = Equal Pct. 50:1 3 = Custom Note: Custom flow curve can only be entered from the Menu system
3	U8	Valve action Default: 1 = Direct Values: 1 = Direct

		2 = Reverse
4	U8	Hold at open status Default: 2 = Off Values: 1 = On 2 = Off
5-6	U16	Hold at open time Default: 5 = 5 seconds Range: 0 – 30 Units: seconds
7	U8	Hold at close status Default: 2 = Off Values: 1 = On 2 = Off
8-9	U16	Hold at close time Default: 5 = 5 seconds Range: 0 – 30 Units: seconds
10	U8	Transmitter Action Default: 1 = Direct Values: 1 = Direct 2 = Reverse
11-12	U16	Transmitter fail position Default: 350 = 3.5mA Values: 0 = None 350 = 3.50mA 2150 = 21.50mA

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8.5.10 Write (149) Dead-Band

Request data bytes

Byte	Format	Description
0	U16	Dead-band Range: 10 – 1000 Units: 0.1% - 10%

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.5.11 Write (155) Select Flow Curve

Request data bytes

Byte	Format	Description
0	U8	Flow Curve Values: 1 = Linear 2 = Equal Pct. 50:1 3 = Custom

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.5.12 Write (156) Sensor Valve Action direction

Request data bytes

Byte	Format	Description
0	U8	Sensor valve action direction Values: 1 = Direct 2 = Reverse

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.5.13 Write (157) Regulator - Hold at open - Status

Request data bytes

Byte	Format	Description
0	U8	Hold at Open – Status Values: 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.5.14 Write (158) Regulator - Hold at open - Time

Request data bytes

Byte	Format	Description
0	U16	Hold at Open – Time Range: 0 – 30 Units: seconds

Response data bytes

Byte	Format	Description
0	U16	*Value written*

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8.5.15 Write (159) Regulator - Hold at close - Status

Request data bytes

Byte	Format	Description
0	U8	Hold at Close – Status Values: 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.5.16 Write (160) Regulator - Hold at close - Time

Request data bytes

Byte	Format	Description
0	U16	Hold at Close – Time Range: 0 – 30 Units: seconds

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.5.17 Write (161) Transmitter Action

Request data bytes

Byte	Format	Description
0	U8	Transmitter Action Values: 1 = Direct 2 = Reverse

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.5.18 Write (162) Transmitter Fail Position

Request data bytes

Byte	Format	Description
0	U16	Transmitter Fail Position Default: 350 = 3.5mA Values: 0 = Not supported 350 = 3.50mA 2150 = 21.50mA

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.6 Advanced Menu Functions

8.6.1 Read (163) All Advanced Menu functions

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description	Values
0	U8	Valve Function Open DO1	Default: 3 = Not Used Values: 3 = Not Used 1 = On 2 = Off
1	U8	Valve Function Open DO2	
2	U8	Valve Function Open DO3	
3	U8	Valve Function Open DO4	
4	U8	Valve Function Close DO1	
5	U8	Valve Function Close DO2	
6	U8	Valve Function Close DO3	
7	U8	Valve Function Close DO4	
8	U8	Valve Function Stay-put DO1	
9	U8	Valve Function Stay-put DO2	
10	U8	Valve Function Stay-put DO3	
11	U8	Valve Function Stay-put DO4	
12	U8	Valve Function Fail Position DO1	
13	U8	Valve Function Fail Position DO1	
14	U8	Valve Function Fail Position DO1	
15	U8	Valve Function Fail Position DO1	

8.6.2 Read (164) All Advanced Menu functions

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	Position Feedback Select
1	U8	Output port at 0%
2	U8	Output port at 100%
3	U16	End position Dead band
5	U8	Error Signal Port Output
6	U16	Dead band hysteresis
8	U16	Calibration Noise
10	U16	Position ADC Zero
12	U16	Position ADC Top
14	U32	Calibration Traveling Time Opening Milliseconds
18	U32	Calibration Traveling Time Closing Milliseconds
22	U8	Ok Signal Port Output

See detailed description under Write command

8.6.3 Read (165) All Advanced Menu functions

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U32	Open Time On Milliseconds
4	U32	Open Time Off Milliseconds
8	U32	Close Time On Milliseconds
12	U32	Close Time Off Milliseconds
16	U16	Regulator pulse open Pct.
18	U16	Regulator pulse close Pct.

See detailed description under Write command

8.6.4 Read (211) All Advanced Menu functions

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	Read Off Signal
1	U8	Read Local Signal
2	U8	Read ESD Signal
3	U8	Read Open Signal
4	U8	Read Close Signal

See detailed description under Write command

8.6.5 Read (248) All Advanced Menu functions (stepping)

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	Read Stepping status
1	U8	Read Fail step
2	U16	Read Open off-time extra time
4	U16	Read Close off-time extra time
6	U8	Read open end pulses
7	U8	Read close end pulses

See detailed description under Write command

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8.6.6 Write (166) Configuration - Valve Function Open DO1

Request data bytes

Byte	Format	Description
0	U8	Valve Function Open DO1 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.6.7 Write (167) Configuration - Valve Function Open DO2

Request data bytes

Byte	Format	Description
0	U8	Valve Function Open DO2 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.6.8 Write (168) Configuration - Valve Function Open DO3

Request data bytes

Byte	Format	Description
0	U8	Valve Function Open DO3 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.6.9 Write (169) Configuration - Valve Function Open DO4

Request data bytes

Byte	Format	Description
0	U8	Valve Function Open DO4 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

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8.7 Write (170) Configuration - Valve Function Close DO1

Request data bytes

Byte	Format	Description
0	U8	Valve Function Close DO1 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.1 Write (171) Configuration - Valve Function Close DO2

Request data bytes

Byte	Format	Description
0	U8	Valve Function Close DO2 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.2 Write (172) Configuration - Valve Function Close DO3

Request data bytes

Byte	Format	Description
0	U8	Valve Function Close DO3 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.3 Write (173) Configuration - Valve Function Close DO4

Request data bytes

Byte	Format	Description
0	U8	Valve Function Close DO4 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.4 Write (174) Configuration - Valve Function Stay-Put DO1

Request data bytes

Byte	Format	Description
0	U8	Valve Function Stay-Put DO1 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.5 Write (175) Configuration - Valve Function Stay-Put DO2

Request data bytes

Byte	Format	Description
0	U8	Valve Function Stay-Put DO2 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.6 Write (176) Configuration - Valve Function Stay-Put DO3

Request data bytes

Byte	Format	Description
0	U8	Valve Function Stay-Put DO3 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.7 Write (177) Configuration - Valve Function Stay-Put DO4

Request data bytes

Byte	Format	Description
0	U8	Valve Function Stay-Put DO4 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

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8.7.8 Write (243) Configuration - Valve Function Fail Position DO1

Request data bytes

Byte	Format	Description
0	U8	Valve Function Fail Position DO1 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.9 Write (244) Configuration - Valve Function Fail Position DO2

Request data bytes

Byte	Format	Description
0	U8	Valve Function Fail Position DO2 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.10 Write (245) Configuration - Valve Function Fail Position DO3

Request data bytes

Byte	Format	Description
0	U8	Valve Function Fail Position DO3 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

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8.7.11 Write (246) Configuration - Valve Function Fail Position DO4

Request data bytes

Byte	Format	Description
0	U8	Valve Function Fail Position DO4 Write Values: 3 = Not Used 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.12 Write (178) Configuration - Position Feedback Select

Request data bytes

Byte	Format	Description
0	U8	Position Feedback Select Values to write: 1 = Position Sensor 2 = AI0 – Position Loop

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.13 Write (179) Configuration - End position – Output signal 0% - Port Select

Request data bytes

Byte	Format	Description
0	U8	Write End position – Output signal 0% - Port Select Values: 0 = None 1 = DO1 2 = DO2 3 = DO3 4 = DO4 5 = DO5 6 = DO6

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.14 Write (180) Configuration - End position – Output signal 100% - Port Select

Request data bytes

Byte	Format	Description
0	U8	Write End position – Output signal 100% - Port Select Values: 0 = None 1 = DO1 2 = DO2 3 = DO3 4 = DO4 5 = DO5 6 = DO6

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.15 Write (181) Configuration - End position – Dead-band

Request data bytes

Byte	Format	Description
0	U16	End position – Dead-band Values to write: Range: 10 – 1000 Units: 0.1% - 10.0%

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.7.16 Write (182) Configuration - Error Signal – Output signal

Request data bytes

Byte	Format	Description
0	U8	Write Error Signal – Output signal Values: 0 = None 1 = DO1 2 = DO2 3 = DO3 4 = DO4 5 = DO5 6 = DO6

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.17 Write (247) Configuration - Ok Signal – Output signal

Request data bytes

Byte	Format	Description
0	U8	Write Ok Signal – Output signal Values: 0 = None 1 = DO1 2 = DO2 3 = DO3 4 = DO4 5 = DO5 6 = DO6

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.18 Write (183) Control Parameters - Dead-band Hysteresis

Request data bytes

Byte	Format	Description
0	U16	Dead-band Hysteresis Values to write Range: 5 - 1000 Units: 0.05% - 10.0%

Response data bytes

Byte	Format	Description
0	U16	*Value written*

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8.7.19 Write (185) Control Parameters – ADC - Position Sensor

Request data bytes

Byte	Format	Description
0	U16	Position ADC 1st end (Minimum Value) Value from Position Sensor or Position Loop Values to write: Range: 0 – 65535 Units: ADC raw value

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.7.20 Write (186) Control Parameters – ADC - Position Sensor

Request data bytes

Byte	Format	Description
0	U16	Position ADC 2nd end (Maximum Value) Value from Position Sensor or Position Loop Values to write: Range: 0 – 65535 Units: ADC raw value

Response data bytes

Byte	Format	Description
0	U16	*Value written*

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8.7.21 Write (189) Control Parameters - Open Time - On Milliseconds

Request data bytes

Byte	Format	Description
0	U32	Open Time On Milliseconds Values to write: Range: 5 – 1500 Units: milliseconds

Response data bytes

Byte	Format	Description
0	U32	*Value written*

8.7.22 Write (190) Control Parameters - Open Time - Off Milliseconds

Request data bytes

Byte	Format	Description
0	U32	Open Time Off Milliseconds Values to write: Range: 5 – 1500 Units: milliseconds

Response data bytes

Byte	Format	Description
0	U32	*Value written*

8.7.23 Write (191) Control Parameters - Close Time - On Milliseconds

Request data bytes

Byte	Format	Description
0	U32	Close Time On Milliseconds Values to write: Range: 5 – 1500 Units: milliseconds

Response data bytes

Byte	Format	Description
0	U32	*Value written*

8.7.24 Write (192) Control Parameters - Close Time - Off Milliseconds

Request data bytes

Byte	Format	Description
0	U32	Close Time Off Milliseconds Values to write: Range: 5 – 1500 Units: milliseconds

Response data bytes

Byte	Format	Description
0	U32	*Value written*

8.7.25 Write (193) Control Parameters - Pulse open distance

Request data bytes

Byte	Format	Description
0	U16	Pulse open distance Values to write: Range: 0 – 10000 0.00% – 100.00%

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.7.26 Write (194) Control Parameters - Pulse close distance

Request data bytes

Byte	Format	Description
0	U16	Pulse close distance Values to write: Range: 0 – 10000 0.00% – 100.00%

Response data bytes

Byte	Format	Description
0	U16	*Value written*

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8.7.27 Write (213) Off Signal – Input port

Request data bytes

Byte	Format	Description
0	U8	Off Signal - Input Port Write Values: 0 = None 1 = DI1 2 = DI2 3 = DI3 4 = DI4 5 = DI5 6 = DI6 7 = DI7 8 = DI8

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.28 Write (214) Local Signal – Input port

Request data bytes

Byte	Format	Description
0	U8	Local Signal - Input Port Write Values: 0 = None 1 = DI1 2 = DI2 3 = DI3 4 = DI4 5 = DI5 6 = DI6 7 = DI7 8 = DI8

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.29 Write (215) ESD Signal – Input port

Request data bytes

Byte	Format	Description
0	U8	ESD Signal - Input Port Write Values: 0 = None 1 = DI1 2 = DI2 3 = DI3 4 = DI4 5 = DI5 6 = DI6 7 = DI7 8 = DI8

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.7.30 Write (236) Open Signal – Input port

Request data bytes

Byte	Format	Description
0	U8	Open Signal - Input Port Write Values: 0 = None 1 = DI1 2 = DI2 3 = DI3 4 = DI4 5 = DI5 6 = DI6 7 = DI7 8 = DI8

Response data bytes

Byte	Format	Description
0	U8	*Value written*

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8.7.31 Write (237) Close Signal – Input port

Request data bytes

Byte	Format	Description
0	U8	Open Signal - Input Port Write Values: 0 = None 1 = DI1 2 = DI2 3 = DI3 4 = DI4 5 = DI5 6 = DI6 7 = DI7 8 = DI8

Response data bytes

Byte	Format	Description
0	U8	*Value written*

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8.8 Pump Control Menu Functions

8.8.1 Read (195) Read All Pump control functions

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	Pump Control Output Port Default: 0 = Not used Values: 0 = Not used 1 = DO1 2 = DO2 3 = DO3 4 = DO4 5 = DO5 6 = DO6
1	U8	Pump Controller mode Default: 1 Values: 1 = Always Off 2 = Always On 3 = Auto
2	U8	Max Running time – Status Default: 0 = Not Used Values: 0 = Not Used 1 = On 2 = Off
3	U16	Max Running time – Time Default: 120 Values: 0-255 Units: 0-255 sec
5	U8	Pressure sensor signal input Default: 0

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		Value: 0 = None 2 = AI2 3 = AI3 4 = AI4 5 = AI5 6 = DI1 and DI2 7 = DI3 and DI4 8 = DI5 and DI6 9 = DI7 and DI8
6	U16	Loop – Pump conf. Pump Start at pressure value Default: 8000 = 80.00 bar Range: 0 – 50000 Units: 0.00 – 500.00 bar
8	U16	Loop – Pump conf. Pump Stop at pressure value Default: 12000 = 120.00 bar Range: 0 – 500 Units: 0.00 – 500.00 bar
10	U16	Loop – Pressure Sensor conf. 4 mA Value Default: 0 = 0.00 bar Range: 0 – 50000 Units: 0.00 – 500.00 bar
12	U16	Loop – Pressure Sensor conf. 20 mA Value Default: 15000 = 150 bar Range: 0 – 50000 Units: 0.00 – 500.00 bar

8.8.2 Read (212) Read All Pump control functions

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	Read Pump Control - Motor Safety Relay Input Port Values: 0 = None 1 = DI1 2 = DI2 3 = DI3 4 = DI4 5 = DI5 6 = DI6 7 = DI7 8 = DI8
1	U8	Read Pump Control - Pressure signal switch type Default: Normally Open (NO) Values: 0 = Not Defined 1 = Normally Open (NO) 2 = Normally Close (NC)
2	U8	Read Pump Control – Level input signal port Values: 0 = None 1 = AI2 2 = AI3 3 = AI4 4 = AI5 5 = DI1 6 = DI2 7 = DI3 8 = DI4 9 = DI5 10 = DI6 11 = DI7 12 = DI8

3	U16	Read Pump Control – Pump stop - Minimum level where pump should stop. Default: 100 mm Values: 0 – 9999 Units: 0 – 9999 mm
5	U16	Read Pump Control - Level – Loop 4mA value Default: 0 mm Values: 0 – 9999 Units: 0 – 9999 mm
7	U16	Read Pump Control - Level – Loop 20mA value Default: 700 mm Values: 0 – 9999 Units: 0 – 9999 mm
9	U8	Read Pump Control – Level signal switch type Values: 0 = Not Defined 1 = Normally Open (NO) 2 = Normally Close (NC)
10	U8	Read Pump Control – Temperature input signal port Values: 0 = None 1 = AI2 2 = AI3 3 = AI4 4 = AI5 5 = DI1 6 = DI2 7 = DI3 8 = DI4 9 = DI5 10 = DI6 11 = DI7 12 = DI8

11	U16	Read Pump Control – Pump stop High temperature Limit - Maximum temperature where the pump shall stop. Values: 73 – 1123 Units 73 Kelvin to 1123 Kelvin (-200°C to 850°C)
13	U8	Read Pump Control – Pump stop High temperature Status Values: 0 = Not defined 1 = On 2 = Off
14	U16	Read Pump Control – Pump stop Low temperature Limit - Minimum temperature where the pump shall stop. Values: 73 – 1123 Units 73 Kelvin to 1123 Kelvin (-200°C to 850°C)
16	U8	Read Pump Control – Pump stop Low temperature Status Values: 0 = Not defined 1 = On 2 = Off
17	U16	Read Pump Control - Temperature – Loop 4mA value Default: 273 Kelvin = 0°C 73 – 1123 Units 73 Kelvin to 1123 Kelvin (-200°C to 850°C)
19	U16	Read Pump Control - Temperature – Loop 20mA value Default: 373 Kelvin = 100°C 73 – 1123 Units 73 Kelvin to 1123 Kelvin (-200°C to 850°C)
21	U8	Read Pump Control – Temperature signal switch type Values: 0 = Not Defined 1 = Normally Open (NO) 2 = Normally Close (NC)

8.8.3 Write (196) Pump – Output port

Request data bytes

Byte	Format	Description
0	U8	Pump – Output port Values to write: 0 = None 1 = DO1 2 = DO2 3 = DO3 4 = DO4 5 = DO5 6 = DO6

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.8.4 Write (197) Pump Controller mode

Request data bytes

Byte	Format	Description
0	U8	Pump Controller mode Values to write: Values: 1 = Always Off 2 = Always On 3 = Auto

Response data bytes

Byte	Format	Description
0	U8	*Value written*

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8.8.5 Write (198) - Pump - Max Running time - Status

Request data bytes

Byte	Format	Description
0	U8	Max Running time - Status Default: 2 = Off Values: 0 = Not defined 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.8.6 Write (199) Pump - Max Running time - Time

Request data bytes

Byte	Format	Description
0	U16	Max Running time – Time Default: 120 Values: 0-255 Units: 0-255 sec

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.8.7 Write (200) Pump - Control Pressure – Input Signal port

Request data bytes

Byte	Format	Description
0	U8	Pressure – Input Signal port Default: 0 Value: 0 = None 2 = AI2 3 = AI3 4 = AI4 5 = AI5 6 = DI1 and DI2 7 = DI3 and DI4 8 = DI5 and DI6 9 = DI7 and DI8

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.8.8 Write (201) Pump Control Pressure - Pump start pressure value

Request data bytes

Byte	Format	Description
0	U16	Loop – Pump conf. Pump Start at pressure value Default: 8000 = 80.00 bar Range: 0 – 50000 Units: 0.00 – 500.00 bar

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.8.9 Write (202) Pump Control Pressure - Pump stop pressure value

Request data bytes

Byte	Format	Description
0	U16	Loop – Pump conf. Pump Stop at pressure value Default: 12000 = 120.00 bar Range: 0 – 50000 Units: 0.00 – 500.00 bar

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.8.10 Write (203) Pump – Control Pressure – Pressure sensor configure 4mA Value

Request data bytes

Byte	Format	Description
0	U16	Loop - Pressure Sensor – Configure 4mA Value Default: 0 = 0.00 bar Range: 0 – 50000 Units: 0.00 – 500.00 bar

Response data bytes

Byte	Format	Description
0	U16	*Value written*

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8.8.11 Write (204) Pump Control Pressure - Pressure Sensor config 20mA Value

Request data bytes

Byte	Format	Description
0	U16	Loop - Pressure Sensor – Conf. 20mA Value Default: 15000 = 150 bar Range: 0 – 50000 Units: 0.00 – 500.00 bar

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.8.12 Write (221) Pump Control - Motor Safety Relay Input Port

Request data bytes

Byte	Format	Description
0	U8	Write Pump Control - Motor Safety Relay Input Port Values: 0 = None 1 = DI1 2 = DI2 3 = DI3 4 = DI4 5 = DI5 6 = DI6 7 = DI7 8 = DI8

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.8.13 Write (222) Pump Control - Pressure signal switch type

Request data bytes

Byte	Format	Description
0	U8	Write Pump Control - Pressure signal switch type Values: 0 = Not Defined 1 = Normally Open (NO) 2 = Normally Close (NC)

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.8.14 Write (223) Pump Control – Level input signal port

Request data bytes

Byte	Format	Description
0	U8	Write Pump Control – Level input signal port Values: 0 = None 1 = AI2 2 = AI3 3 = AI4 4 = AI5 5 = DI1 6 = DI2 7 = DI3 8 = DI4 9 = DI5 10 = DI6 11 = DI7 12 = DI8

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.8.15 Write (224) Pump Control – Pump stop at minimum level

Request data bytes

Byte	Format	Description
0	U16	Write Pump Control – Pump stop at minimum level - Minimum level where pump should stop. Default: 100 mm Values: 0 – 9999 Units: 0 – 9999 mm

Response data bytes

Byte	Format	Description
0	U6	*Value written*

8.8.16 Write (225) Pump Control – Level – Loop 4mA value

Request data bytes

Byte	Format	Description
0	U16	Write Pump Control - Level – Loop 4mA value Values: 0 – 9999 Units: 0 – 9999 mm

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.8.17 Write (226) Pump Control – Level – Loop 20mA value

Request data bytes

Byte	Format	Description
0	U16	Write Pump Control - Level – Loop 20mA value Values: 0 – 9999 Units: 0 – 9999 mm

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.8.18 Write (227) Pump Control – Level signal switch type

Request data bytes

Byte	Format	Description
0	U8	Write Pump Control – Level signal switch type Values: 1 = Normally Open (NO) 2 = Normally Close (NC)

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.8.19 Write (228) Pump Control – Temperature input signal port

Request data bytes

Byte	Format	Description
0	U8	Write Pump Control – Temperature input signal port Values: 0 = None 1 = AI2 2 = AI3 3 = AI4 4 = AI5 5 = DI1 6 = DI2 7 = DI3 8 = DI4 9 = DI5 10 = DI6 11 = DI7 12 = DI8

Response data bytes

Byte	Format	Description
0	U8	*Value written*

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8.8.20 Write (229) Pump Control – Pump stop High temperature Limit

Request data bytes

Byte	Format	Description
0	U16	Write Pump Control – Pump stop High temperature Limit - Maximum temperature where the pump shall stop. Values: 73 – 1123 Units 73 Kelvin to 1123 Kelvin (-200°C to 850°C)

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.8.21 Write (230) Pump Control – Pump stop High temperature Status

Request data bytes

Byte	Format	Description
0	U8	Write Pump Control – Pump stop High temperature Status Values: 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.8.22 Write (231) Pump Control – Pump stop Low temperature Limit

Request data bytes

Byte	Format	Description
0	U16	Write Pump Control – Pump stop Low temperature Limit - Minimum temperature where the pump shall stop. Values: 73 – 1123 Units 73 Kelvin to 1123 Kelvin (-200°C to 850°C)

Response data bytes

Byte	Format	Description
0	U16	*Value written*

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8.8.23 Write (232) Pump Control – Pump stop Low temperature Status

Request data bytes

Byte	Format	Description
0	U8	Write Pump Control – Pump stop Low temperature Status Values: 1 = On 2 = Off

Response data bytes

Byte	Format	Description
0	U8	*Value written*

8.8.24 Write (233) Pump Control – Temperature – Loop 4mA value

Request data bytes

Byte	Format	Description
0	U16	Write Pump Control - Temperature – Loop 4mA value Default: 273 Kelvin = 0°C 73 – 1123 Units 73 Kelvin to 1123 Kelvin (-200°C to 850°C)

Response data bytes

Byte	Format	Description
0	U16	*Value written*

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8.8.25 Write (234) Pump Control – Temperature – Loop 20mA value

Request data bytes

Byte	Format	Description
0	U16	Write Pump Control - Temperature – Loop 20mA value Default: 373 Kelvin = 100°C 73 – 1123 Units 73 Kelvin to 1123 Kelvin (-200°C to 850°C)

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.8.26 Write (235) Pump Control – Temperature signal switch type

Request data bytes

Byte	Format	Description
0	U16	Write Pump Control – Temperature signal switch type Values: 1 = Normally Open (NO) 2 = Normally Close (NC)

Response data bytes

Byte	Format	Description
0	U16	*Value written*

8.8.27 Read (238) Read All Pump control functions

Request data bytes

Byte	Format	Description
None		

Response data bytes

Byte	Format	Description
0	U8	Valve open starts pump Default: 2 = No Values: 1 = Yes 2 = No
1	U8	Valve close starts pump Default: 2 = No Values: 1 = Yes 2 = No
2	U8	Valve stayput starts pump Default: 2 = No Values: 1 = Yes 2 = No
3	U16	Pump stop delay Default: 5 sec Values: 0-240 Units: 0-240sec

8.8.28 Write (239) Valve open starts pump

Request data bytes

Byte	Format	Description
0	U8	Valve open starts pump Default: 2 = No Values: 1 = Yes

		2 = No

Response data bytes

Byte	Format	Description
0	U8	Valve open starts pump

8.8.29 Write (240) Valve close starts pump

Request data bytes

Byte	Format	Description
0	U8	Valve close starts pump Default: 2 = No Values: 1 = Yes 2 = No

Response data bytes

Byte	Format	Description
0	U8	Valve close starts pump

8.8.30 Write (241) Valve stayput starts pump

Request data bytes

Byte	Format	Description
0	U8	Valve stayput starts pump Default: 2 = No Values: 1 = Yes 2 = No

Response data bytes

Byte	Format	Description
0	U8	Valve stayput starts pump

8.8.31 Write (242) Pump stop delay

Request data bytes

Byte	Format	Description
0	U8	Pump stop delay Default: 5 sec Values: 0-240 Units: 0-240sec

Response data bytes

Byte	Format	Description
0	U8	Pump stop delay

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9 HART Response Codes

All commands can return all the following response codes

Byte	Class	Description
0	Success	
2	Error	Invalid poll address
2	Error	Invalid selection
3	Error	Passed parameter too large
4	Error	Passed parameter too small
5	Error	Too few data bytes received
6	Error	Device specific command error
7	Error	In write protect mode
8	Warning	Update failure
8	Warning	Update in progress
8	Warning	Set to nearest possible value
9	Error	Invalid data code detected
9	Error	Configuration counter mismatch
12	Error	Invalid mode selection
14	Warning	Dynamic variable returned
16	Error	Access restricted
30	Warning	Command response truncated
32	Error	Busy
33	Error	Device initiated
34	Error	Device running
35	Error	Device dead
36	Error	Device conflict
64	Warning	Command not implemented

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